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Evaluation of Breast Lump with Sonography of Breast and MRI of Breast with Dynamic Contrast

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Abstract: ***Background :****Clinically palpable breast lump , has remained a diagnostic challenge . Multimodality comparative imaging along with histopathological correlation helps in improving accuracy and establishing evidence based characterization of lump/ lesions based on BI-RADS scoring , along with early high specificity detection protocol.* ***Materials and Methods****: In this prospective randomised controlled study, 25 patients over an study duration of 18 months were selected . Inclusion criteria being Clinically palpable breast lump and Sonologicallydemonstrated lesion . Exclusion criteria being BI-RADS category 1, 6. GE Voluson 730 expert linear Probe 12MHZ used for Sono-mammography . MRI of the breast was done on GE Signa HDxt 1.5 T MR Scanner. HD 8 channel VIBRANT breast array coil from GE is used in all patients.Finally Core biopsy of the lesion was done and the histo-pathological report assessment was done. Nature of the lesion as described by MRI and USG was compared with histo-pathological results.*

Results*: Combined Sonomammography , Dynamic Contrast MRI study of clinically palpable , sonographically detectable mass / lump were characterized based on standard checklist of size , echogenicity , margins, calcification , posterior acoustic shadowing/ enhancement , RI Doppler value >/< 0.99 , pseudo echogenic capsule +/- on Ultrasound and T1/T2 W signals , margins , enhancement on MRI . All 25 patients who underwent US and MRI examination were in age group 19-55y years (the median age group of the patient was 36years). Hypoechoic nature, irregular/ spiculated margins, posterior acoustic attenuation ,microcalcifications , Penetrating vascularity with RI values >0.99 – Ultrasound features . Irregular margins , homogenous enhancement , T1W and T2W Hypointensity - MRI findings of Malignant index lesions . The use of sonographic morphological features in the present study obtained a sensitivity of 92.8%, specificity of 72.7%, PPV 81.25% and NPV of 88.9% for malignant lesions. Dynamic contrast MRI gives better characterisation of breast lesions with an excellent diagnostic accuracy showing sensitivity of 100%, specificity of 90%, positive predictive value 93.3% and negative predictive value 100% for malignant breast lesions*

Conclusion:*Ultrasonography as initial screening tool, with Dynamic contrast MRI as adjuvant tool enhances the sensitivity , specificity of diagnosis and characterization of clinically palpable breast lump into benign , malignant bracket with protocol based imaging , helps in improved accuracy*

Key Word*: Sonomammography , Echogenicity, Intensity , RI values , Bi-Rads category .*

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I. Introduction

Mammography, which is readily available, relatively inexpensive and suited to depict microcalcifications, is usually adequate for this purpose in most patients. However, several limitations of mammography are well documented; these include difficulties in the assessment of dense glandular tissue, as well as of regions located close to the chest wall or the axilla. Some cancers may be occult on mammography and in others the extent of the index tumour may be underestimated.Ultrasonography , using HR Linear probe upto 13MHZ , helps in characterizing , clinically palpable lump into solid / cystic nature . Also , accurate characterization of the lesion based on Grey scale , Colour and power doppler imaging into possible Bi Rads category (benign versus malignant) is with very good sensitivity .Ultrasound is a very good tool for needle localization , FNAC and Biopsy of the lesion under guidance . Plain and Dynamic contrast MRI For the primary index lesions, the sensitivity for **MRI** was 100% for predicting a **breast** malignancy. Additional ipsilateral **breast** cancers were detected in32% of **breast** cancer patients and contralateral **breast** cancers in 9% of the patients.MRI of the breast effectively delineates tissue contrast differences and the use of intravenous contrast agents further improves mass conspicuity.

II. Material And Methods

Study Design:A prospective comparative study to compare the sensitivity of ultrasonography and dynamic contrast MRI of breast in determining the benign/malignant nature of breast lesions in patients belonging to BI-RADS category 3,4 and 5.
Study Duration:18 months .
Sample size: 25 patients.
Subjects & selection method: The study population was drawn from patients referred for clinically palpable breast lump and Sonographically detected lesion .

Inclusion criteria:
- Patients with clinically palpable breast lump
- Patients belonging to BI-RADS category 2, 3, 4 and 5.

Exclusion criteria:
- Patient belonging to BI-RADS category 0, 1 and 6.

Procedure methodology

Patients were selected according of the inclusion criteria. Informed written consent was taken form each patient under the study. A thorough clinical history was taken followed by physical examination. Clinically or ultrasonographically detected suspicious breast lesions were subjected to MRI and correlated histopathologically

Ultrasonography

Whole-breast sonography with GE Voluson 730 equipment, using a high frequency (12MHz) linear probe was performed with axial and sagittal scanning of both breasts. Patients were examined in supine position, rotated slightly away from the side of interest to flatten the breast evenly on the chest wall. The ipsilateral arm was positioned behind the head. Suspicious areas such as palpable and non-palpable sonographic abnormalities were also scanned in radial and anti-radial orientation. The ultrasonographic findings were recorded on the performa as shown below-
- Location- Side, Quadrant
- Size
- Shape- Round, oval, lobulated, Irregular.
- Margin- Smooth, Irregular, Spiculated and Angular.
- Pseudocapsule.
- Longitudinal axis versus Anterio posterior diameter.
- Posterior Echo Intensity- Post acoustic Enhancement and Shadowing.
- Echogenicity- Anechoic, Hypoechoic, Isoechoic and Hyperechoic.
- Internal Structure- Cystic, Complex, Homogeneous and Heterogenous.
- Calcification.
- Surrounding Breast Parenchyma.
- Overlying Skin.
- Underlying Muscle and Chest wall.
- Contralateral Breast.
- Bilateral Axillary and Supraclavicular Regions for Lymph Nodes.
- Colour Doppler-Appearance of Blood Vessels and their Pattern of distribution.
- Spectral Waveform- Resistive index.

BI-RADS US Category	**Assessment and Management**
0	**Incomplete: additional imaging evaluation needed**
1	**Negative**
2	**Benign**
3	**Probably benign: short-interval follow-up recommended**
4	**Suspicious: biopsy**
5	**Highly suggestive of malignancy: biopsy**
6	**Know malignancy: treatment ongoing**

Sonographically the lesions were characterized into above mentioned BiRads category .

MRI

All 25 patients underwent MRI examination on a 1.5 T scanner (GE Signa HDxt scanner). HD 8 channel VIBRANT dedicated breast array coil from GE is used in all patients. Before administration of contrast Axial T1 and T2, axial fat saturation T2, STIR T2, sagittal T2 fat saturation of each breast were obtained.

These were followed by dynamic axial / sagittal VIBRANT sequence in which a pre-contrast scanning of bilateral breasts was followed by injection of contrast and saline and then repetition of the scan six times (post-contrast). The sequence was acquired in axial plane including bilateral breasts. We used 10 ml Gadolinium dimeglumine as a contrast agent at the rate of 2ml/s, which was injected with the help of a pressure injector and immediately followed by 10ml saline flush at the rate of 2ml/s. Using these raw data, post- processing was done with the help of in-built software. In post- processing we obtained subtracted images.
Findings were recorded in the proforma as shown below-

Lesion Type –

- Focus/Foci (Tiny spot of enhancement, < 5 mm)
- Mass (Three-dimensional space-occupying lesion)- Shape, Margin
- Mass Enhancement- Homogeneous, Heterogeneous, Rim enhancement, Enhancing/Non-Enhancing internal septations and Central enhancement
- Non mass like enhancement- Ductal, Linear, Segmental, Regional or diffuse
- Axillary and internal mammary lymph node enlargement and enhancement
- Other findings- Nipple retraction/invasion, Pectoralis muscle invasion, Chest wall invasion, Skin thickening (focal or diffuse).

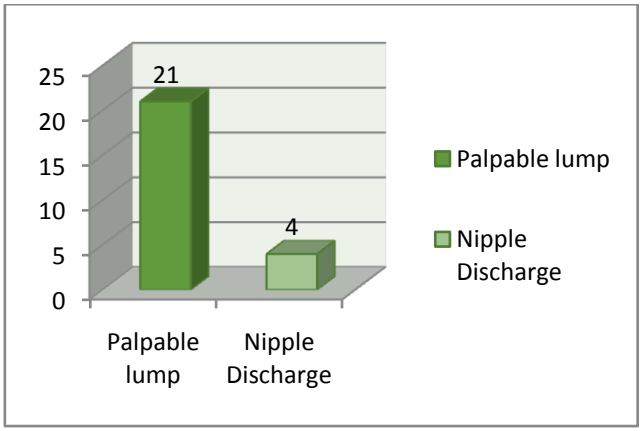
All the patients were subjected to USG guided Biopsy . The histopathology report were correlated with Sono and MRI imaging findings .

III. Result

DISTRIBUTION OF PATIENTS ACCORDING TO AGE GROUP (N=25)

Age Groups (in years)	Number of Patients
11-20	3
21-30	4
31-40	7
41-50	7
51-60	4
Total	25

Presentation



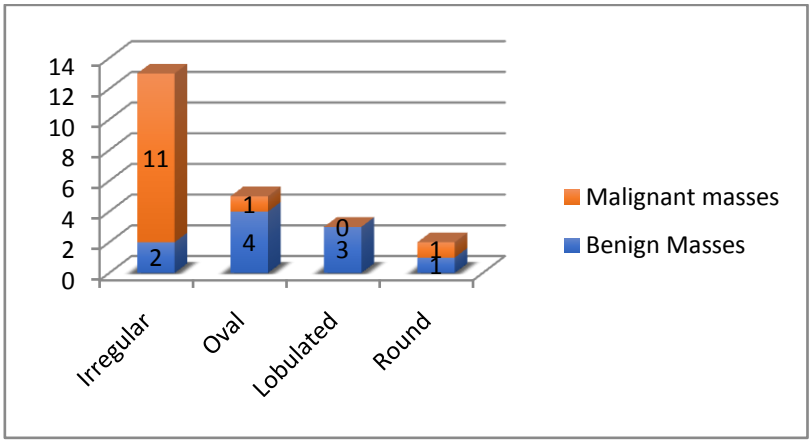
Ultrasonographic findings (n=25)*

Ultrasonographic Findings	Number of Lesions
Mass Only	**14**
Mass with microcalcification	**9**
No Definite Mass	**2**
Skin thickening	**1**
Dilated ducts	**3**
Axillary nodes	**4**

*** Some patients had more than one finding on ultrasonography**

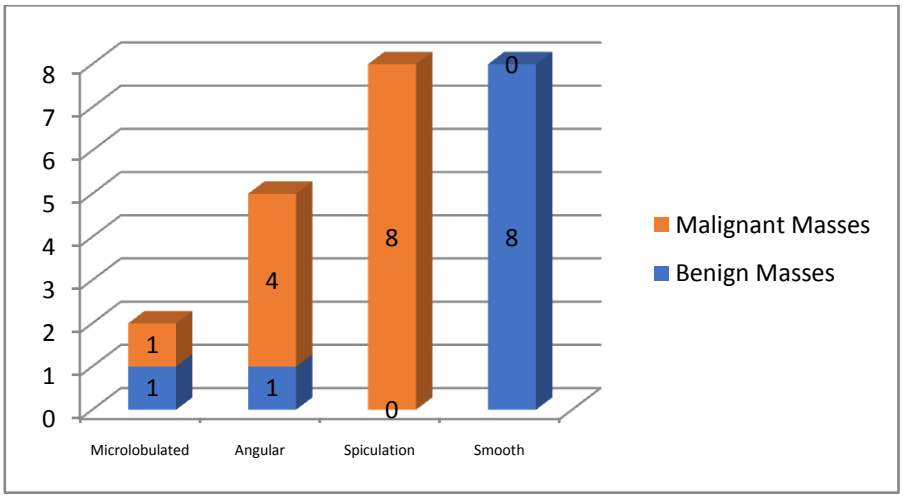
Shape of the Index Mass Lesion on Ultrasonography (n=23)

Shape	Frequency in All Masses	Frequency in Benign Masses	Frequency in Malignant masses
Irregular	**13 (56.5%)**	**2/10 (20%)**	**11/13 (84.6%)**
Oval	**5/23 (21.7%)**	**4/10 (40%)**	**1/13 (7.6%)**
Lobulated	**3/23 (13%)**	**3/10 (30%)**	**0/13 (0.0%)**
Round	**2/23 (8.3%)**	**1/10 (10%)**	**1/13 (7.6%)**



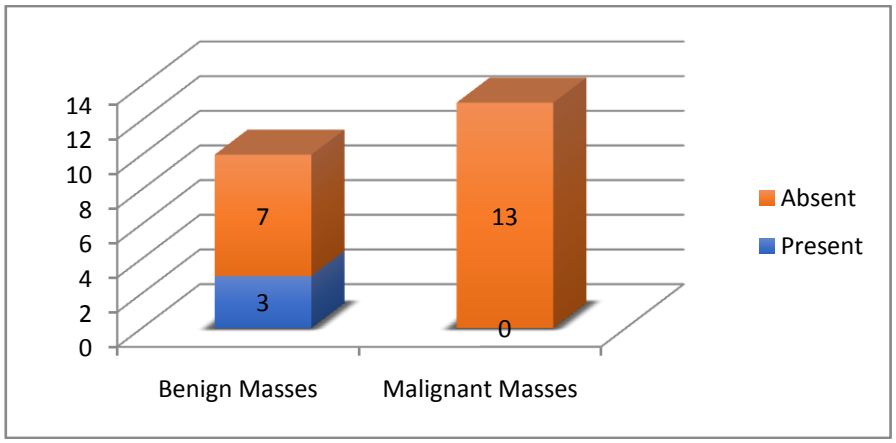
Margins of the Index Lesion on Ultrasonography (n=23)

Margins	Frequency in All Masses	Frequency in Benign Masses	Frequency in Malignant Masses
Microlobulated	2/23 (8.7%)	1/10 (10%)	1/13 (7.6%)
Angular	5/23 (21.7%)	1/10 (10%)	4/13 (33.3%)
Spiculation	8/23 (34.7%)	0/10 (0%)	8/13 (61.5%)
Smooth	8/23 (8.7%)	8/10 (80%)	0/13 (0.0%)



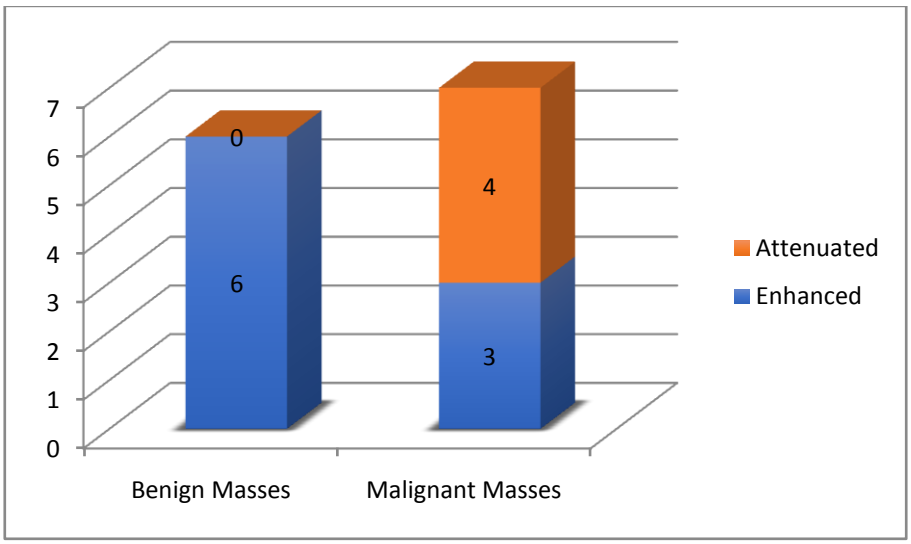
Pseudocapsule in Index Lesion (n=23)

Pseudocapsule	Frequency in All Masses	Frequency in Benign Masses	Frequency in Malignant Masses
Present	3/23 (39%)	3/1(30%)	0/13 (0%)
Absent	20/23 (60.8%)	7/10 (70%)	13/13 (100%)



Posterior Echo Intensity in Index Lesion (n=23)

Posterior Echo Intensity	Frequency in All Masses	Frequency in Benign Masses	Frequency in Malignant Masses
Enhanced	**9/23 (39.1%)**	**6/10 (60%)**	**3/13 (23%)**
Attenuated	**4/23 (17.4%)**	**0/10 (0%)**	**4/13 (30.7%)**



Echogenicity of the Index Lesion (n=23)

Echogenicity	Frequency in All Masses	Frequency in Benign Masses	Frequency in Malignant Masses
Hypoechoic	**22/23 (95.6%)**	**9/10 (90%)**	**13/13 (100%)**
Isoechoic	**1/23 (4.3%)**	**1/10 (10%)**	**0/13 (0%)**
Hyperechoic	**0/23 (0%)**	**0/10 (0%)**	**0/13 (0%)**

Microcalcification in Index Lesion (n=23)

Microcalcification	Frequency in All Masses	Frequency in Benign Masses	Frequency in Malignant Masses
Present	**9/23 (39%)**	**2/10(20)**	**7/13 (53.8%)**
Absent	**14/23 (60.8%)**	**8/10 (80%)**	**6/13 (46.1%)**

Pattern of vascularisation on Index Lesion on Colour Doppler Sonography (n=22)

Pattern of Vascularisation	Frequency in All Masses	Frequency in Benign Masses	Frequency in Malignant Masses
Penetrating	**1/22 (50%)**	**2/10 (20%)**	**9/12 (75%)**
central	**3/22 (13.6%)**	**3/10 (30%)**	**0/12 (0.0%)**
Peripheral	**8/22 (36.4%)**	**5/10 (50%)**	**3/12 (25%)**

Flow Characterisation of Index Lesion on Colour Duplex Sonography (n=22)

Resistive Index Value	Frequency in All Masses	Frequency in Benign Masses	Frequency in Malignant Masses
>0.99	**10/22 (45.4%)**	**1/10 (10%)**	**9/12 (75%)**
<0.99	**12/22 (54.4%)**	**9/10 (90%)**	**3/12 (25%)**

BI-RADS Category of Index Lesions on US (n=25)

BI-RADS Category	Frequency in All Masses	Frequency in Benign Masses	Frequency in Malignant Masses
2	**3/25 (12%)**	**3/11 (27.2%)**	**0/14 (0%)**
3	**5/25 (20%)**	**5/11 (45.4%)**	**0/14 (0%)**
4	**5/25 (20%)**	**3/11 (27.2%)**	**2/14 (14.3%)**
5	**12/25 (48%)**	**0/11 (0%)**	**12/14 (85.7%)**

MRI

All 30 patients underwent MRI examination on a 1.5 T scanner (GE Signa HDxt scanner). HD 8 channel VIBRANT dedicated breast array coil from GE is used in all patients. Before administration of contrast Axial T1 and T2, axial fat saturation T2, STIR T2, sagittal T2 fat saturation of each breast, axial DWI were obtained.

These were followed by dynamic VIBRANT sequence in which a pre-contrast scanning of bilateral breasts was followed by injection of contrast and saline and then repetition of the scan six times (post-contrast).

MRI Findings (n=25)

Findings	Pre-contrast	Post-contrast
Index Mass Lesion	20	24
Axillary nodes	4	4
Skin Thickening	1	1
No Index lesion	5	1
Pectoralis muscle involvement	1	1

Signal Intensity Characteristics of Index Mass Lesions on T1 (n=20)

Signal Intensity Characterstics	Frequency in All Masses	Frequency in Benign Masses	Frequency in Malignant masses
Hypointense	9/20 (45%)	2/8 (25%)	7/12 (58.3%)
Intermediate	1/20 (5%)	1/8 (12.5%)	0/12 (0%)
Isointense	10/20 (50%)	5/8 (62.5%)	5/12 (41.6%)

Signal Intensity Characteristics of Index Mass Lesions on T2 (n=20)

Signal Intensity Characterstics	Frequency in All Masses	Frequency in Benign Masses	Frequency in Malignant masses
Hypointense	9/20 (45%)	0/8 (0%)	9/12 (75%)
Hyperintense and Mixed	8/20 (40%)	6/8 (75%)	2/12 (16.6%)
Isointense	3/20 (15%)	2/8(25%)	1/12 (8.6%)

Shape of Index Lesions on MRI (n=24)

Shape	Frequency in All Masses	Frequency in Benign Masses	Frequency in Malignant masses
Lobulated	**3/24 (12.5%)**	**3/10 (30%)**	**0/14 (0%)**
Round	**5/24 (20.8%)**	**2/10 (20%)**	**3/14 (21.4%)**
Oval	**6/24 (25%)**	**4/10 (40%)**	**2/14 (14.2%)**
Irregular	**10/24 (41.7%)**	**1/10 (10%)**	**9/14 (64.3%)**

Margins of Index Lesions on MRI (n=24)

Margins	Frequency in All Masses	Frequency in Benign Masses	Frequency in Malignant masses
Spiculated	7/24 (29.2%)	0/10 (0%)	7/14 (50%)
Smooth	10/24 (41.7%)	9/10 (90%)	1/14 (7%)
Irregular	7/24 (29.2%)	1/10 (10%)	6/14 (42.8%)

Type of Enhancement in Index Lesions on MRI (n=24)

Type of Enhancement	Frequency in All Masses	Frequency in Benign Masses	Frequency in Malignant masses
Hetero + Rim	4/24 (16.7%)	0/10 (0%)	4/14 (28.6%)
Heterogenous	7/24 (29.2%)	1/10 (10%)	6/14 (42.9%)
Homogenous	13/24 (54%)	9/10 (90%)	4/14 (28.6%)

BI-RADS Category of Index Lesions on MRI (n=25)

BI-RADS Category	Frequency in All Masses	Frequency in Benign Masses	Frequency in Malignant masses
2	9/25 (32%)	9/11 (72.7%)	0/14 (0%)
3	1/25 (4%)	1/11 (9.1%)	0/14 (0%)
4	2/25 (8%)	1/11 (9.1%)	1/14 (7.1%)
5	13/25 (52%)	0/11 (0%)	13/14 (92.8%)
Total	25	11	14

HISTOPATHOLOGIC FINDINGS:

Histopathology was the gold standard in our study. All the 25 cases were subjected to histopathological examination for final diagnosis.

Histopathology for the Final Diagnosis of the Index Lesion (n=25)

S.No.	Breast Lesion	NO. of Cases	Case Percentage
1	Carcinoma	14	56
2	Fibroadenoma	5	20
3	Papillary Breast Lesion	3	16
4	Others	2	8
5	No Lesion	1	4

Histopathology for Type of Carcinoma in Index Lesions (n=14)

Type of Tumor	Number of Lesions
IDC	12
Medullary carcinoma	2
ILC	0
DCIS alone	0

Comparison of BI-RADS Categories Assigned According to Ultrasonography and MRI (n=25)

Patient Number	BI-RADS Category on USG	BI-RADS Category on MRI
1	5	5
2	4	5
3	3	2
4	5	5
5	5	5
6	5	5
7	3	2
8	1	4
9	5	5
10	5	5
11	5	5
12	5	5
13	1	1
14	4	3

15	**5**	**5**
16	**2**	**2**
17	**5**	**5**
18	**4**	**4**
19	**4**	**5**
20	**5**	**5**
21	**2**	**2**
22	**4**	**2**
23	**3**	**2**
24	**2**	**2**
25	**3**	**2**

Comparison of US classification with pathologic findings in 25 breast lesions.

US	Total no.	Pathologic Findings		Total no.
		Benign	Malignant	
Benign (N+B+PB)	**9 (2+3+4)**	**8 (True negative)**	**1 (False negative)**	**9**
Malignant (PM+M)	**16 (5+11)**	**3 (False positive)**	**13 (True positive)**	**16**

Comparison of MRI classification with pathologic findings in 25 breast lesions.

MRI	Total no.	Pathologic Findings		Total no.
		Benign	Malignant	
Benign (N+B+PB)	**10 (1+8+1)**	**10 (True negative)**	**0 (False negative)**	**10**
Malignant (PM+M)	**15 (2+13)**	**1 (False positive)**	**14 (True positive)**	**15**

Image Plate 1: Case of Medullary Carcinoma

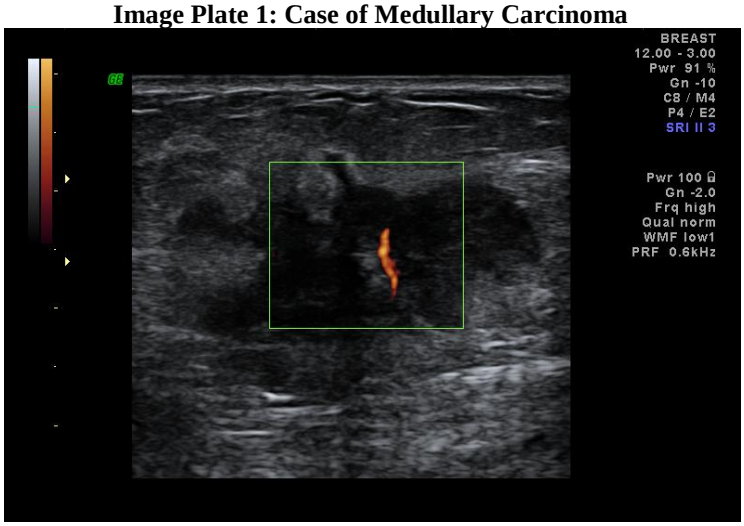
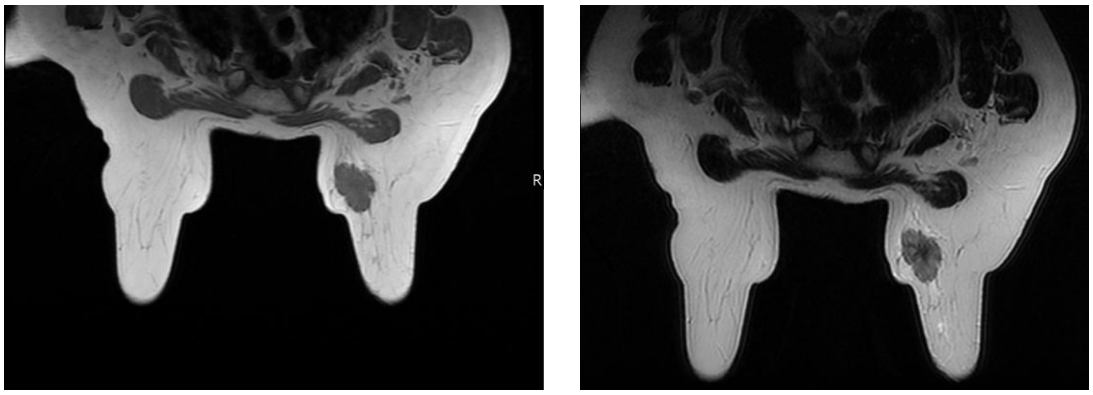
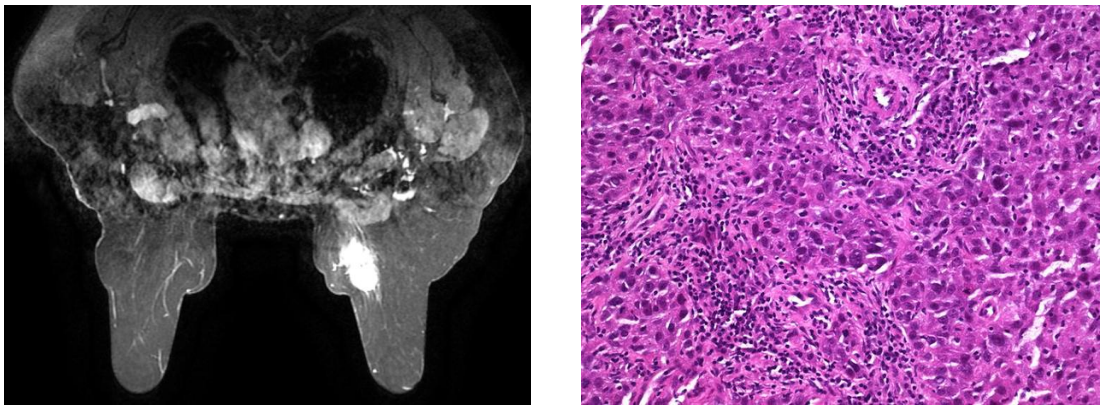


Fig 4.1: USG Image showing hypoechoic mass lesion with penetrating artery. Resistive index of the lesion was more than 0.99



(a) **(b)**

Fig 4.2: MRI Axial T1W (a) and T2W (b) images showing hypo intense mass lesion with central area of necrosis in the right breast.



(a) **(b)**

Fig 4.3: (a) MRI Axial T1W post dynamic contrast phase:3 image showing homogenous enhancement of the mass in the right breast. Spiculated margins of the lesion is well made out. (b) High power microscopic picture demonstrates anaplastic tumor cells with syncytial appearance with surrounding lymphoplasmacytic infiltrate: Medullary carcinoma of breast.

Image Plate 2: Case of Fibroadenoma

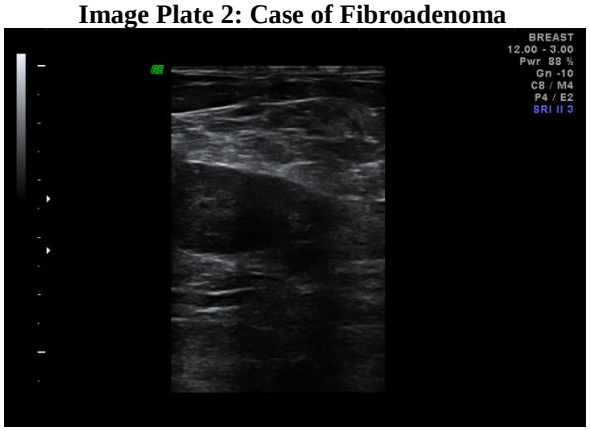
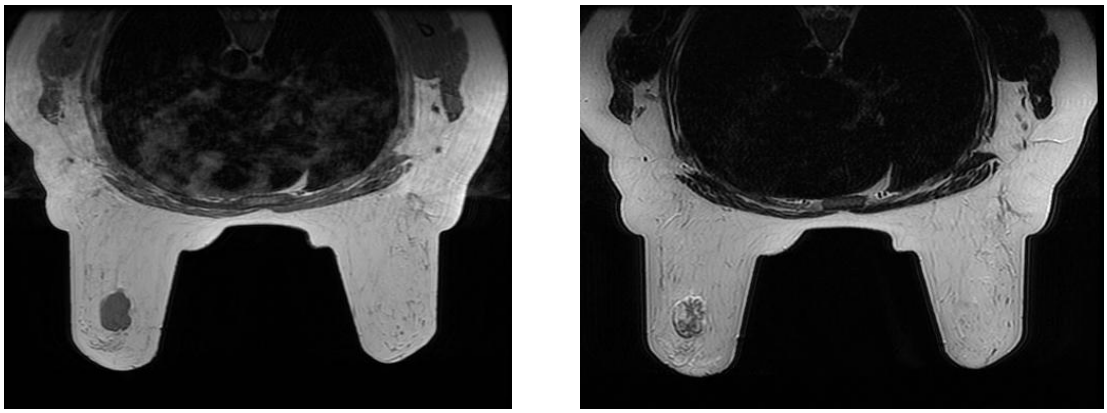
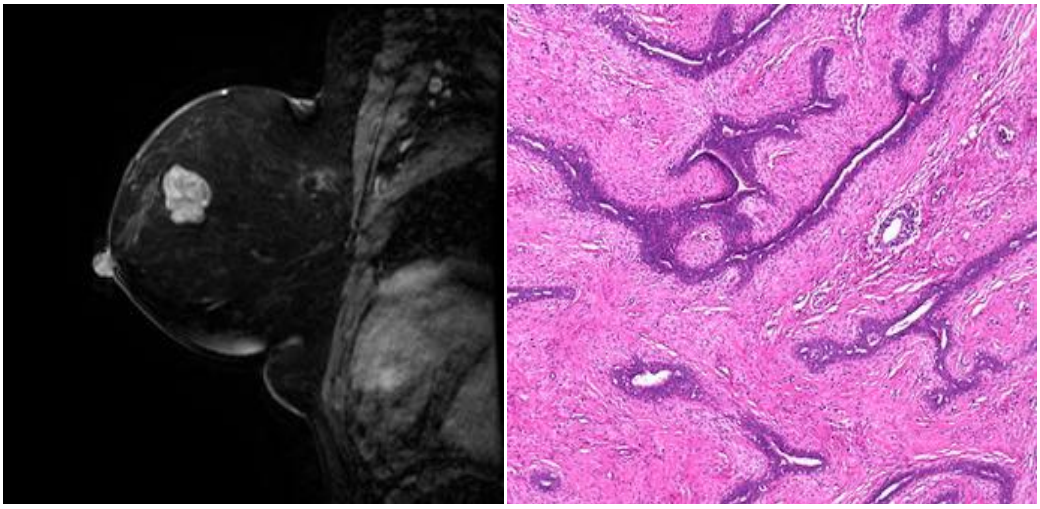


Fig 5.1: USG of the breast shows smooth margined hypoechoic lesion with few specks of calcification.



(a) **(b)**

Fig5.2: MRI Axial T1W (a) and T2W (b) images shows smooth margined lesion with macrolobulations in the left breast. The lesion appears iso intense on T1W images and mixed intensity on T2W images.



(a) **(b)**

Fig5.3: (a) MRI Sagittal post dynamic contrast phase:3 image showing homogenous enhancement of the mass in the left breast with smooth margins and macrolbulations. (b) Low power microscopic picture demonstrates increased stromal component with intracanalicular invagination of the stromal connective tissue: fibroadenoma- intracanalicular type.

Image Plate 3:Case of Intra-ductal Carcinoma

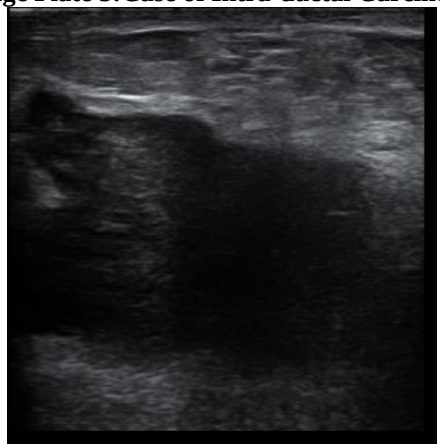
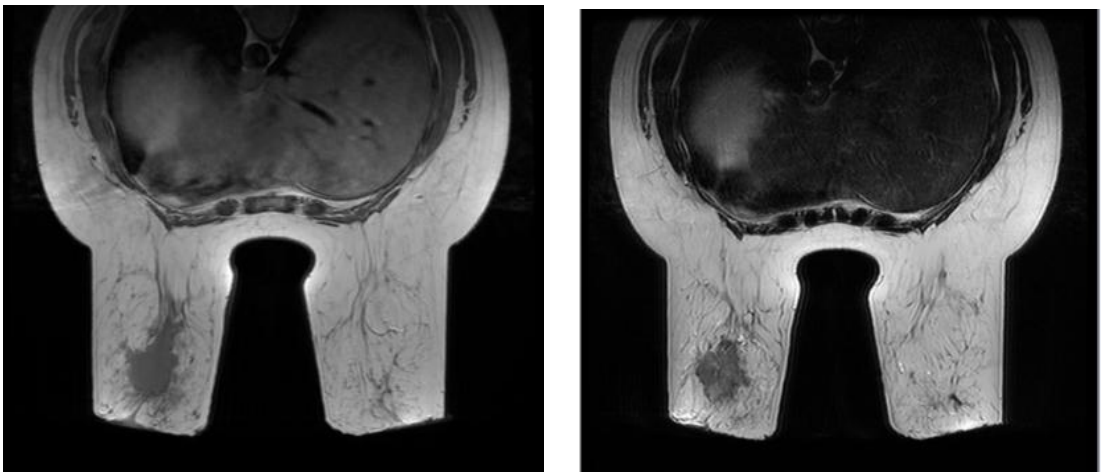


Fig6.1: USG image showing hypoechoic mass lesion with angular margins.



(a) **(b)**

Fig6.2: MRI Axial T1W (a) and T2W (b) images show spiculated margined mass lesion with ductal communication in the retro-areolar region of the left breast. The lesion appears hypo intense on T1W and mixed intensity on T2W images.

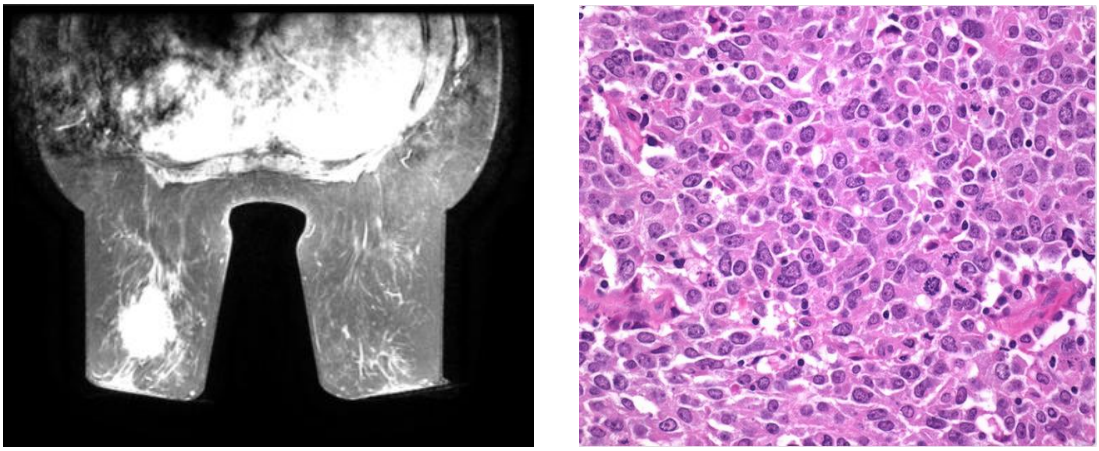


Fig 6.3: (a) MRI Axial T1Wpost dynamic contrast phase:3 image showing intense enhancement of the mass with spiculated margins and intra-ductal communication is seen in the retro-areolar region of the left breast. (b) High power microscopic picture demonstrates highly cellular discohesive clusters of ductal epithelial cells with pleomorphic hyperchromatic nuclei: high-grade intra-ductal carcinoma.

Image plate 4 Case of Invasive ductal Carcinoma

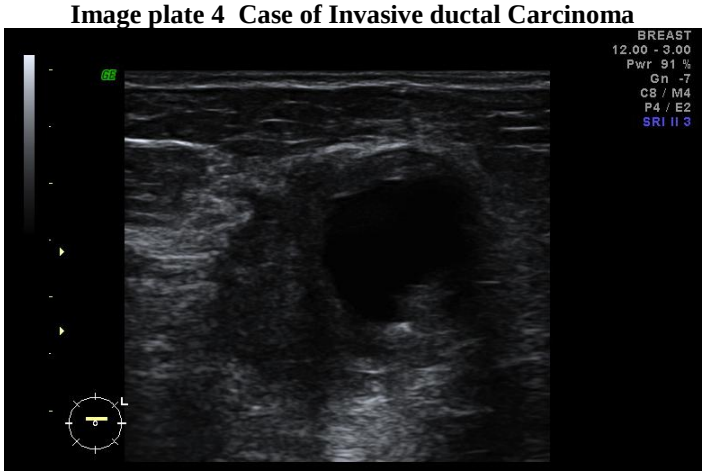
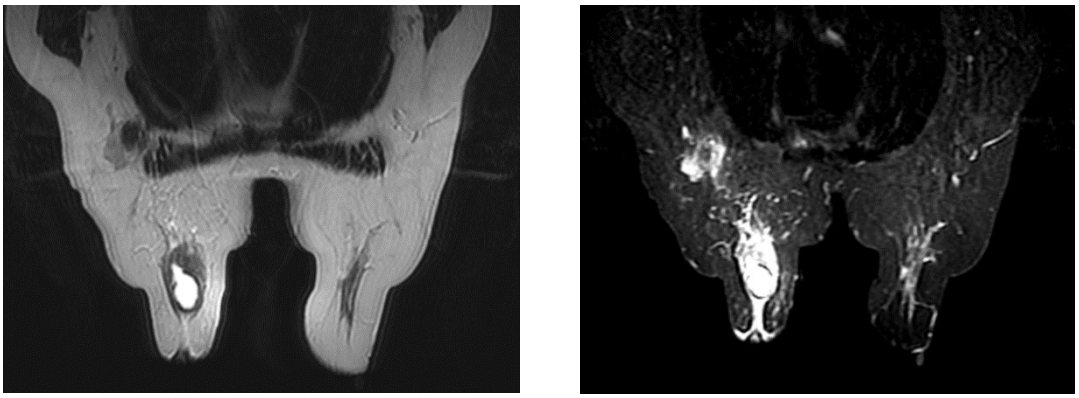
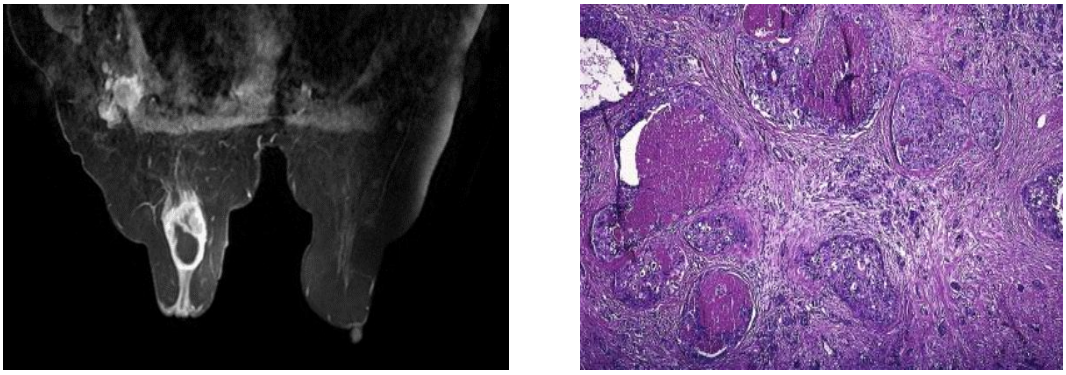


Fig 8.1: USG images showing mass lesion with irregular margins and area of cystic lesion. Eccentric intra-cystic soft tissue noted.



(a) **(b)**

Fig 8.2: (a) MRI Axial T2W image showing mass lesion with heterogeneous signal intensity with cystic area within the lesion in the retro-areolar region of the left breast. (b) MRI Axial STIR image showing hyperintense signal mass lesion in the retro-areolar region of the left breast with dilated duct seen running from the mass lesion to the nipple region. Both images show necrotic lymph nodes in the left axilla.



(a) **(b)**

Fig 8.3: (a) MRI Axial T1W post dynamic contrast phase: 3 image shows heterogeneously enhancing mass lesion with peripheral rim enhancement is seen in the retro-areolar region of the left breast. Necrotic left axillary lymph node shows peripheral enhancement. (b) Low power microscopic picture shows highly cellular ductal epithelial cells with pleomorphic hyperchromatic nuclei seen invading into the stromal tissue: Invasive ductal carcinoma.

Image Plate 5 InvasiveDuctal Carcinoma

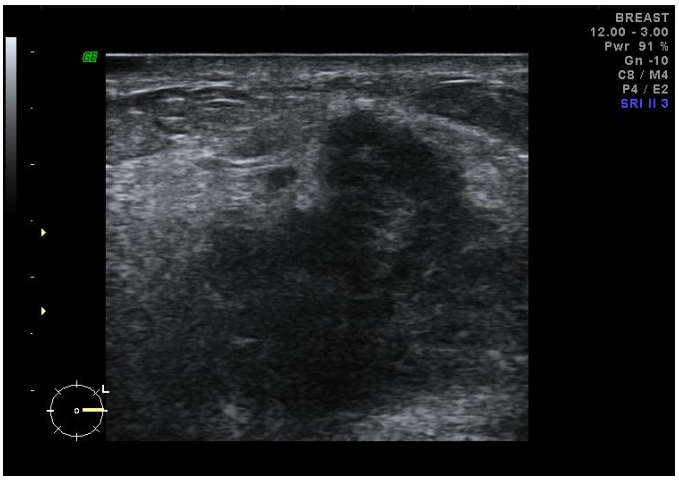
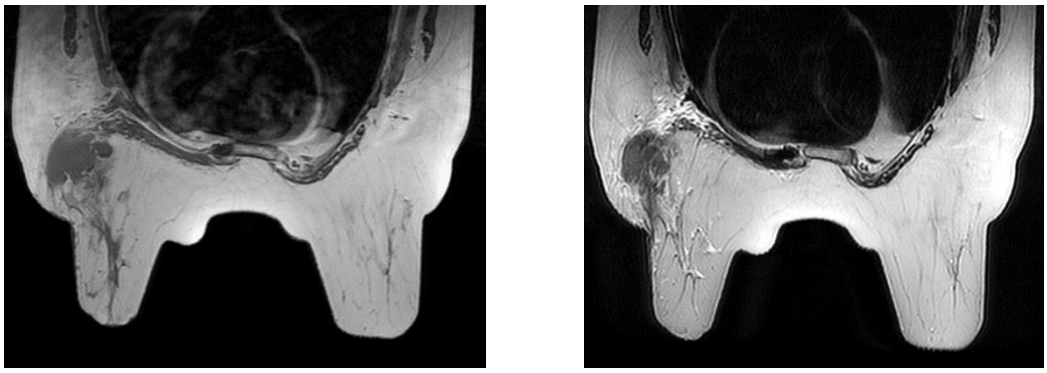
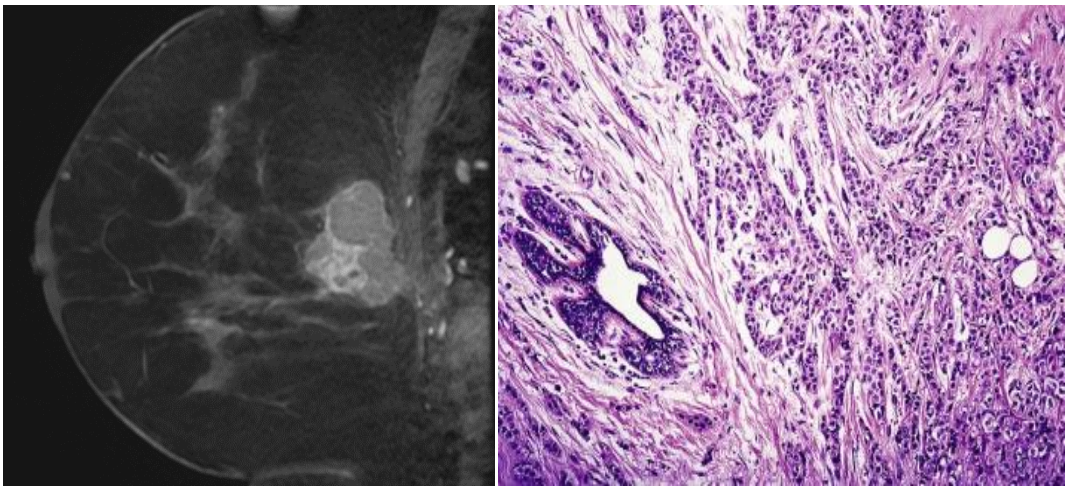


Fig 9.1: USG image shows ill-defined heterogeneous echogenic mass lesion with micro-lobulations is seen in the right breast lesion.



(a) **(b)**

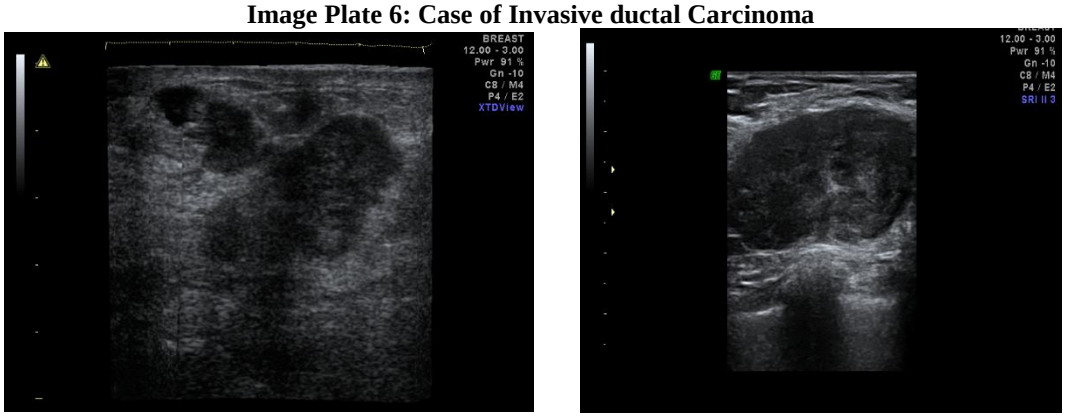
Fig 9.2: MRI Axial T1W (a) and Axial T2W (b) images showing iso to hypointense mass lesion with irregular margins and in communication with a dilated duct extending upto the areolar region in the right breast. Mass lesion appears to be in close relation to the pectoral muscle.



(a) **(b)**

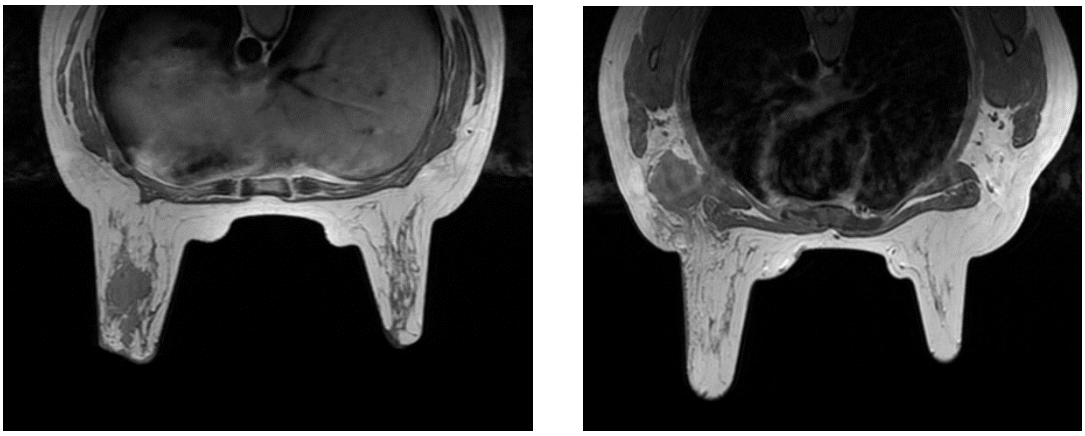
Fig 9.3: (a) MRI Sagittal post dynamic contrast phase:3 image showing heterogeneously enhancing mass lesion with peripheral rim enhancement in retro-areolar region of the left breast, in close proximity with the pectoralis muscle. There is minimal enhancement of the pectoral muscle. (b) Low power microscopic picture shows highly cellular ductal epithelial cells with pleomorphic hyperchromatic nuclei invading the stromal tissue arranged in sheets and cords: Invasive ductal carcinoma

Image Plate 6: Case of Invasive ductal Carcinoma



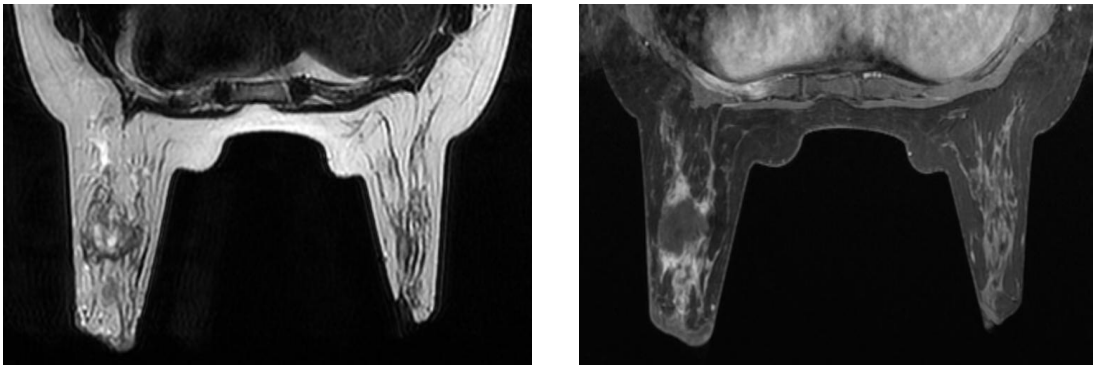
(a) **(b)**

Fig 10.1: USG images (a) showing hypoechoic mass lesion with angular margins and large axillary lymph adenopathy (b) in the left breast.



(a) **(b)**

Fig 10.2: Axial T1W images showing iso-hypo intense mass lesion in the retro-areolar region of left breast (a) with adjacent dilated duct and enlarged right axillary lymph node (b).



(a) **(b)**

Fig 10.3: Axial T2W image (a) shows heterogeneously intense mass lesion with irregular margins with areas of necrosis in the retro-areolar region of the left breast. Axial T1W post dynamic contrast phase: 3 image (b) shows heterogeneous enhancing mass lesion with peripheral rim enhancement in the retro-areolar region of the left breast. Intra-ductal mass with peripheral enhancement is seen extending from the mass to the areolar region.

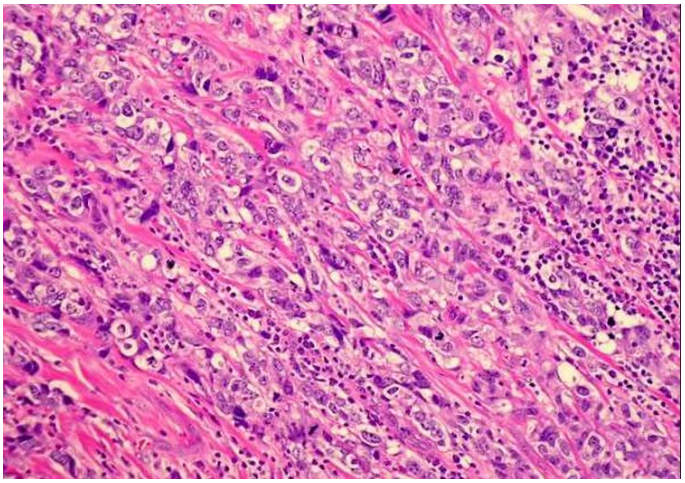


Fig 10.4: High power microscopic picture shows pleomorphic highly cellular ductal epithelial cells with pleomorphic hyperchromatic nuclei seen invading into the stromal tissue arranged in sheets and cords: Invasive ductal carcinoma

Image Plate 7:Case of Medullary Carcinoma

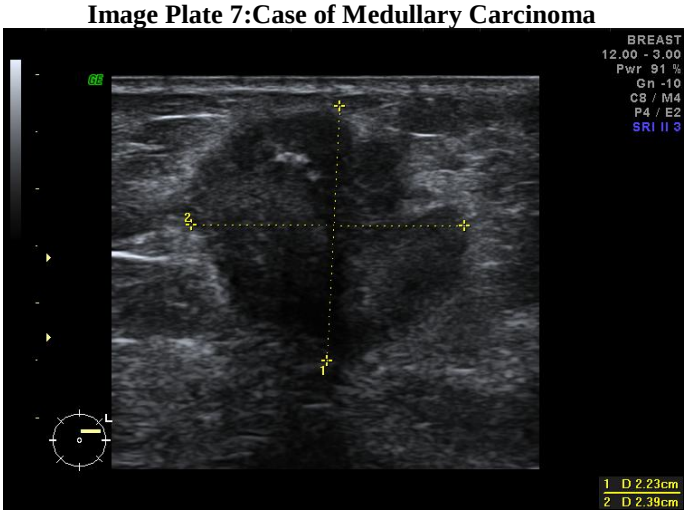
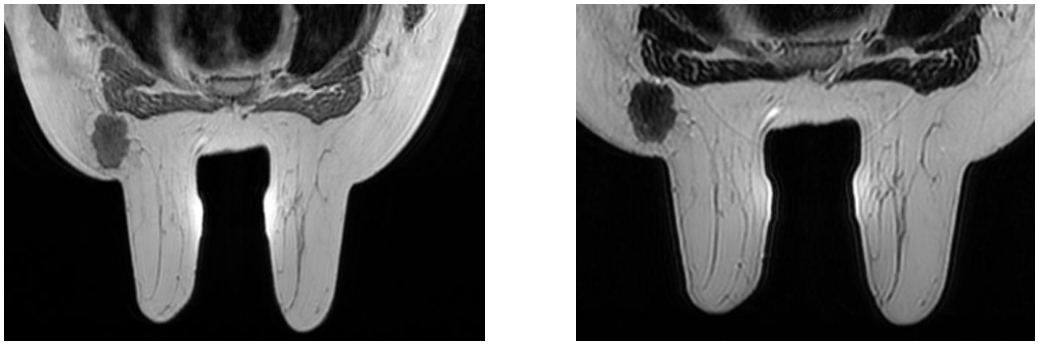


Fig 11.1: USG image showing large hypo-echoic mass lesion with areas of specks of calcification in the axillary tail of the left breast.



(a) **(b)**

Fig 11.2: MRI Axial T1W (a) and axial T2W (b) images show hypo-intense mass lesion with micro-lobulations in the axillary tail of the left breast.

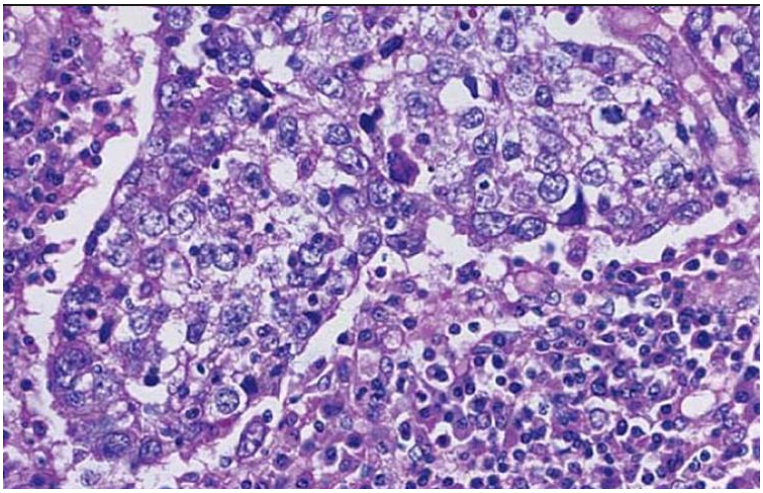
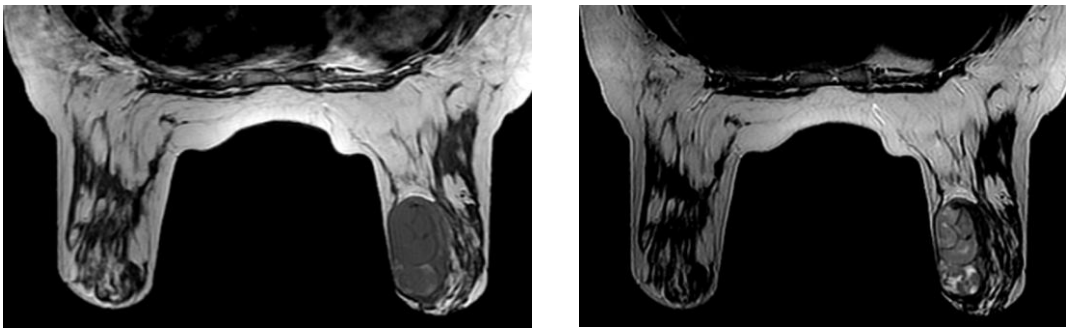


Fig 11.3: High power microscopic picture shows large tumor cells in a syncytial fashion and are sharply separated from the surrounding stroma which is heavily infiltrated by lymphocytes and plasma cells.

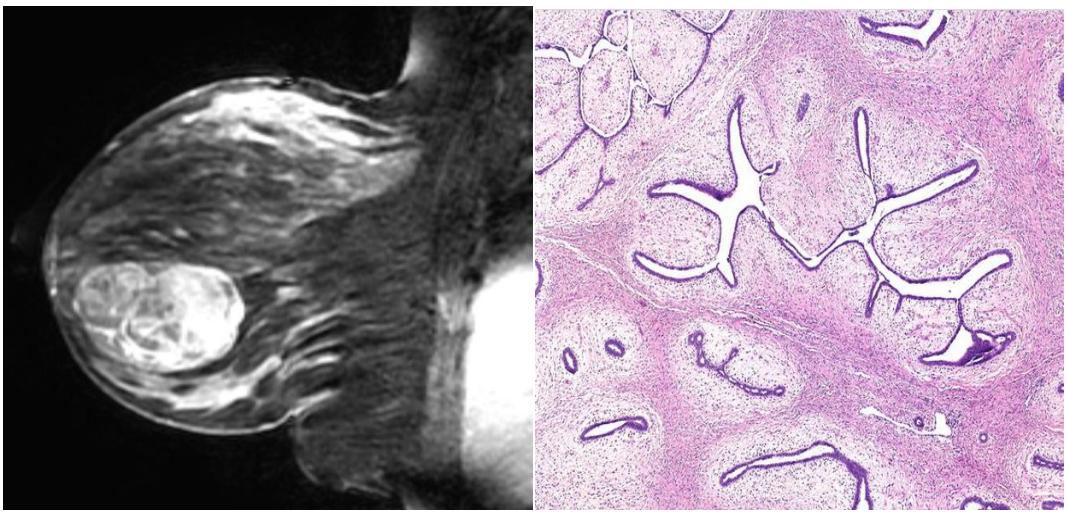
Image Plate 8: Case Phyllodes Tumor

Fig 12.1: USG image showing large smooth margined, capsulated, hypoechoic mass lesion with multiple septations noted in the right breast.



(a) **(b)**

Fig 12.2: Axial T1W image (a) showing well defined hypointense mass lesion with multiple septations in the retro-areolar region of the right breast. Axial T2W image (b) showing iso to hypo intense mass lesion with multiple septations is seen in the retro-areolar region of the right breast. Significant mass effect on the breast gladular architecture is well made out.

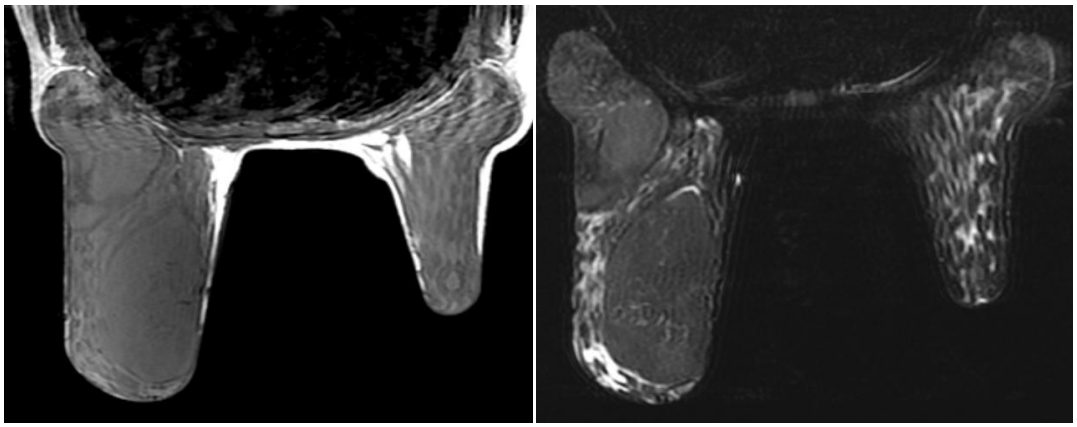


(a) **(b)**

Fig 12.3: (a) MRI Sagittal post dynamic contrast phase:3 image showing heterogeneously enhancing mass lesion with multiple septations with few necrotic areas. (b) Low power microscopic picture demonstrates nodular structure with a prominent stromal proliferation in periductal region.

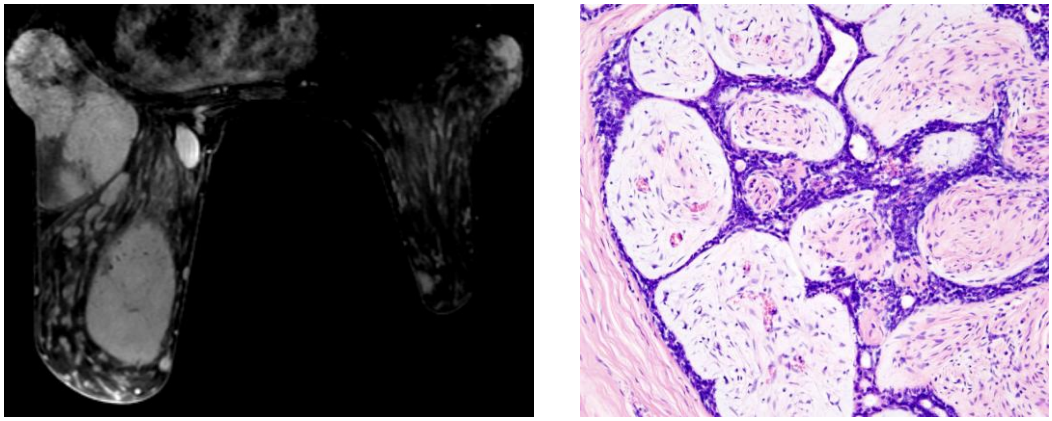
Image Plate 9 Case of Juvenile Giant Fibroadenoma

Fig 13.1: USG image showing well defined, capsulated, heterogeneous echogenic mass noted in the left breast of a 15 year old girl.



(a) **(b)**

Fig 13.2: MRI Axial T1W (a) and T2W (b) images showing large well defined, iso- hypo intense mass lesion in the retro-areolar region of the left breast. Another similar lesion is seen in the axillary tail of the left breast. Both the lesions are causing significant distortion of the normal breast parenchymal architecture.



(a) **(b)**

Fig 13.3: Axial T1W post dynamic contrast phase: 3 image (a) shows large homogenous enhancing, well capsulated mass lesion in the retro-areolar region of the left breast. Another lesion in the axillary tail of the left breast shows similar homogenous enhancement. (b) High power microscopic picture shows well encapsulated lesion with glandular and stromal component.

IV. Discussion And Conclusion

- This was a prospective study to assess the diagnostic efficacy of US and MRI in clinically and ultrasonographically suspected breast lesions to differentiate benign from malignant lesions and to determine the extent of primary breast carcinoma.
- Twenty-five female patients with suspected breast masses presenting to surgery departments, were included in the study.
- The median age of the patients was 36 years (age range=19-55 years).
- A palpable breast lump was the most common presenting complaint (n=21, 84%). Some patients had more than one complaint.
- All 25 patients underwent US and MRI examination.
- Ultrasound was performed using high frequency probe (GE Voluson 730 equipment)
- Focal mass was the most common ultrasonographic finding (n=23, 92%). Associated axillary nodes were seen in 4 patients.
- All of the malignant lesions were hypoechoic (100%). Majority of them showed irregular shape (84.6%) with spiculated margin (61.5%) and distal acoustic attenuation in 30.7%.
- Majority of the benign lesions showed oval (40%) and lobulated shape (30%). Echogenic pseudocapsule surrounding the lesion was seen in 30% of cases. Other sonographic features included hypoechogenicity (90%) and smooth margin in 80% cases.
- On colour Doppler sonography colour signal were seen in 92.3% of malignant and 100 % of benign lesions. Majority of the malignant lesions showed penetrating pattern of vascularisation (75%). Spectral Doppler analysis of breast lesions RI >0.99 in 75% of malignant lesions and RI <0.99 in 90% of benign lesions.
- Four patients of carcinoma breast showed metastatic deposits in axillary lymph nodes.
- The use of sonographic morphological features in the present study obtained a sensitivity of 92.8%, specificity of 72.7%, PPV 81.25% and NPV of 88.9% for malignant lesions.
- Based on the BI-RADS classification according to American College of Radiology breast lesions were categorized as benign, probably benign, probably malignant and malignant.
- Eleven malignant lesions were categorized as BI-RADS 5 and 2 lesions as BI-RADS 4 on ultrasonography.
- MRI examination was done on a 1.5 T scanner (GE Signa HDxt MRI scanner system).
- We obtained pre-contrast axial-T1W/TSE, T2W/TSE, T2W/SPIR; coronal-STIR; sagittal-T2W/SPIR sequences with a slice thickness of 4mm. These were followed by dynamic post-contrast 3D-WATS/S sequences. Post-processing was done and signal intensity-time curves were obtained.
- Twenty-four out of 25 index lesions were detected on post-contrast MRI and 20 index lesions could be detected before the administration of contrast. On TIW 53.8% and on T2W 69.2% malignant index lesions were hypointense.
- The most common shape seen in malignant lesions on MRI was irregular (n=9, 64.3%), the most common margin was spiculated (n=7, 50%) followed by irregular margin (n=6, 42.8%) and heterogenous enhancement was the most common type of enhancement (n=6, 42.9%).
- The most common shape seen in benign lesions on MRI was oval (n=4, 40%), the most common margin was smooth (n=9, 90%) and homogenous enhancement was the most common type of enhancement (n=9, 90%).
- No additional lesions were seen on MRI in the same breast. Contralateral disease was not seen in any patient in our study.
- All the primary tumours were IDC on histopathology except two that was medullary carcinoma.
- We found that MRI is more sensitive than US for the detection of index tumours.
- In the present study MRI showed sensitivity of 100%, specificity of 90%, positive predictive value 93.3% and negative predictive value 100% malignant breast lesions.
- We suggest the following MRI protocol for breast carcinoma. Pre-contrast axial-T1W/TSE, T2W/TSE, T2W/STIR; sagittal-T2W/STIR sequences followed by dynamic Post contrast 3D-VIBRANT imaging.
- There were some limitations in our study. First, we studied a small number of patients. Secondly, we did not have the facility for MRI guided biopsy in our institute, so we could not biopsy the additional suspicious lesions visible on MRI alone.To conclude, MRI is a very sensitive imaging modality for the evaluation of suspicious breast lesions and the disease extent is better evaluated than ultrasonography. It also detects ultrasonographically occult lesions in post-operative patients. Preoperative breast MRI is recommended in diagnosed cases of breast cancer, who are considered for BCS and also to rule out recurrence in patients previously operated for carcinoma breast.

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